

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
November 2006



**SCIENCE A**  
**Unit Chemistry C1a (Products from Rocks)**

**CHY1A**

**CHEMISTRY**  
**Unit Chemistry C1a (Products from Rocks)**

Wednesday 22 November 2006 Morning Session

**For this paper you must have:**

- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

Time allowed: 30 minutes

**Instructions**

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Products from Rocks' printed on it.
- Attempt **one Tier only**, either the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

**Instructions for recording answers**

- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:
- Do **not** extend beyond the circles.
- If you want to change your answer, **you must** cross out your original answer, as shown:
- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:

1 2 3 4  
○ ● ○ ○

1 2 3 4  
○ ⊗ ○ ●

1 2 3 4  
○ ⊗ ○ ⊗

**Information**

- The maximum mark for this paper is 36.

**Advice**

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Higher Tier starts on page 14 of this booklet.

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**FOUNDATION TIER**

**SECTION ONE**

Questions **ONE** to **SIX**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

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**QUESTION ONE**

This question is about metals.

Match metals, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

- A** calcium
- B** copper
- C** gold
- D** titanium

	<b>What we can say about the metal</b>
<b>1</b>	It is most commonly found in the earth as the metal itself.
<b>2</b>	It is the main metal in limestone.
<b>3</b>	It is used for electrical wires and water pipes.
<b>4</b>	It is often used because of its low density.

**QUESTION TWO**

This question is about the properties of transition metals.

Match properties, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

- A** good conductors
- B** high melting points
- C** made into alloys
- D** tough

	<b>What this tells you about transition metals</b>
<b>1</b>	They are mixed with similar metals to make them harder for everyday use.
<b>2</b>	They are liquids only if they are very hot.
<b>3</b>	They allow an electric current to pass through them easily.
<b>4</b>	They do not crack or crumble if you hit them with a hammer.

**Turn over for the next question**

**Turn over ►**

### QUESTION THREE

The diagram shows part of the periodic table.

<b>Na</b>	<b>Mg</b>																
<b>K</b>							<b>Fe</b>										

Match elements, **A**, **B**, **C** and **D**, with the numbers 1–4 in the table.

- A** aluminium (Al)
- B** iron (Fe)
- C** oxygen (O)
- D** potassium (K)

	<b>What we can say about the element</b>
<b>1</b>	It has a low density and resists corrosion.
<b>2</b>	It has properties similar to those of sodium.
<b>3</b>	It is often combined with metals in ores.
<b>4</b>	It is a transition metal.

**QUESTION FOUR**

This question is about the fuels shown in the table.

Name of fuel	Cost per kg	Heat energy released per kg	Quantity of waste products		
			Soot	Ash	Sulfur dioxide
Coal	24 p	36 000 J	High	High	High
Ethanol	80 p	26 000 J	None	None	None
Heating oil	46 p	46 000 J	Medium	None	Medium
Natural gas	40 p	52 000 J	None	None	Low

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A** costs 1 p to produce 1000 J of heat energy
- B** causes least pollution
- C** releases the most heat energy per kg
- D** is likely to produce the most acid rain

Coal is the fuel that ... **1** . . . .

Ethanol is the fuel that ... **2** . . . .

Heating oil is the fuel that ... **3** . . . .

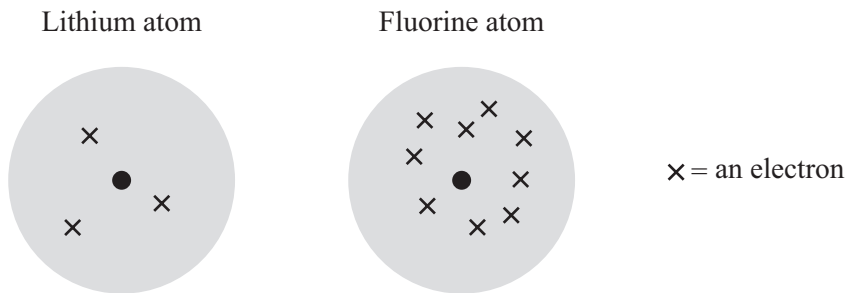
Natural gas is the fuel that ... **4** . . . .

**Turn over for the next question**

**Turn over ►**

**QUESTION FIVE**

This question is about a lithium atom combining with a fluorine atom to form a compound.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A**    a bond
- B**    an electron
- C**    an element
- D**    a nucleus

In the diagrams, ● represents ... **1** ... .

Lithium is ... **2** ... .

When lithium and fluorine react, the fluorine atom takes ... **3** ... from the lithium atom.

The atoms are then held together by ... **4** ... .

**QUESTION SIX**

This question is about four hydrocarbons in crude oil.

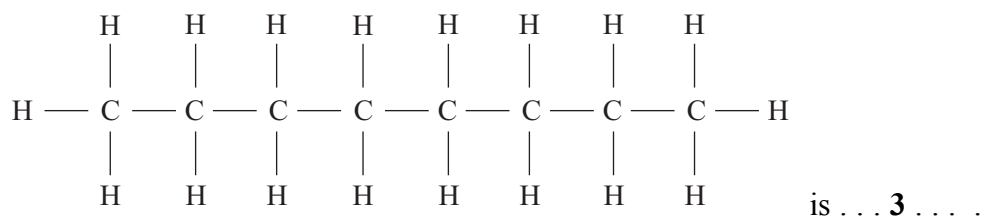
Name of hydrocarbon	Formula	Boiling point (°C)
<b>A</b> methane	CH <sub>4</sub>	- 162
<b>B</b> pentane	C <sub>5</sub> H <sub>12</sub>	+ 36
<b>C</b> octane	C <sub>8</sub> H <sub>18</sub>	+ 126
<b>D</b> nonane	C <sub>9</sub> H <sub>20</sub>	+ 150

Match hydrocarbons, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

The hydrocarbon with the highest boiling point is . . . **1** . . . .

The hydrocarbon which is a gas at 0 °C is . . . **2** . . . .

The hydrocarbon with the structural formula



The hydrocarbon with 17 atoms in a molecule is . . . **4** . . . .

**Turn over for the next question**

**Turn over ►**

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**SECTION TWO**Questions **SEVEN** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION SEVEN**

A student heats 6.0 grams of green copper carbonate in a test tube.

The copper carbonate decomposes, giving off a gas. A black powder is left in the tube.

The student weighs the tube every 30 seconds during the experiment.

**Results**

<b>Time in seconds</b>	0	30	60	90	120	150	180
<b>Mass of the contents of the test tube in grams</b>	6.0	5.1	4.5	4.2	4.0	4.0	4.0

**7A** The gas given off when the copper carbonate is heated is . . .

- 1 carbon dioxide.
- 2 carbon monoxide.
- 3 copper oxide.
- 4 oxygen.

**7B** What is the black powder left in the test tube?

- 1 carbon
- 2 copper
- 3 copper oxide
- 4 copper sulfate



**7C** In the experiment, the decomposition of the copper carbonate was completed between . . .

- 1 30 and 60 seconds.
- 2 60 and 90 seconds.
- 3 90 and 120 seconds.
- 4 150 and 180 seconds.

**7D** The student repeats the experiment but this time uses 3.0 grams of copper carbonate.

What mass of black powder should the student expect to get at the end of the experiment?

- 1 1.0 grams
- 2 2.0 grams
- 3 4.0 grams
- 4 8.0 grams

**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

National parks are beautiful areas where people can enjoy the countryside. People live and work in national parks.

In some national parks there are large limestone quarries. The limestone is usually transported from the quarries by road to all parts of the country.

The development of large quarries means a loss of habitat for wildlife, although areas can be restored when quarrying is finished.

**8A** One argument **for** limestone quarrying in national parks is that . . .

- 1 it creates more space for wildlife.
- 2 it provides jobs for local people.
- 3 it provides a large area for people to enjoy.
- 4 it reduces visual pollution.

**8B** One argument **against** limestone quarrying in national parks is that . . .

- 1 it encourages wildlife to live in the national parks.
- 2 there are no roads in the national parks.
- 3 quarries make unsightly scars on the landscape.
- 4 we do not use limestone for buildings now.

**8C** Transporting limestone by road causes noise pollution, air pollution and damage to buildings.

These problems could be reduced by . . .

- 1 transporting the limestone by lorries at night.
- 2 transporting the limestone by rail.
- 3 using larger lorries.
- 4 using smaller lorries.

**8D** Limestone is an important raw material in the manufacture of . . .

- 1 aluminium.
- 2 cement.
- 3 copper.
- 4 sulfur dioxide.

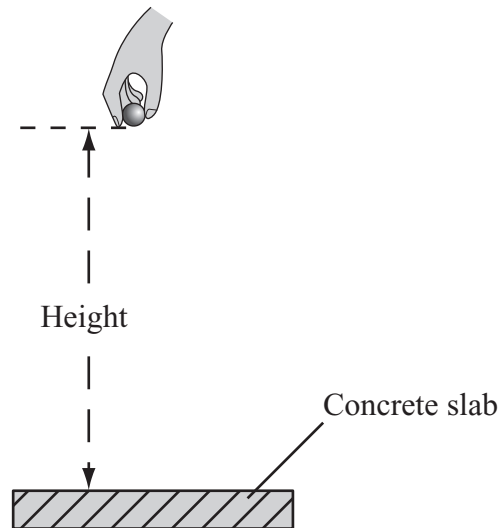
**Turn over for the next question**

**Turn over ►**

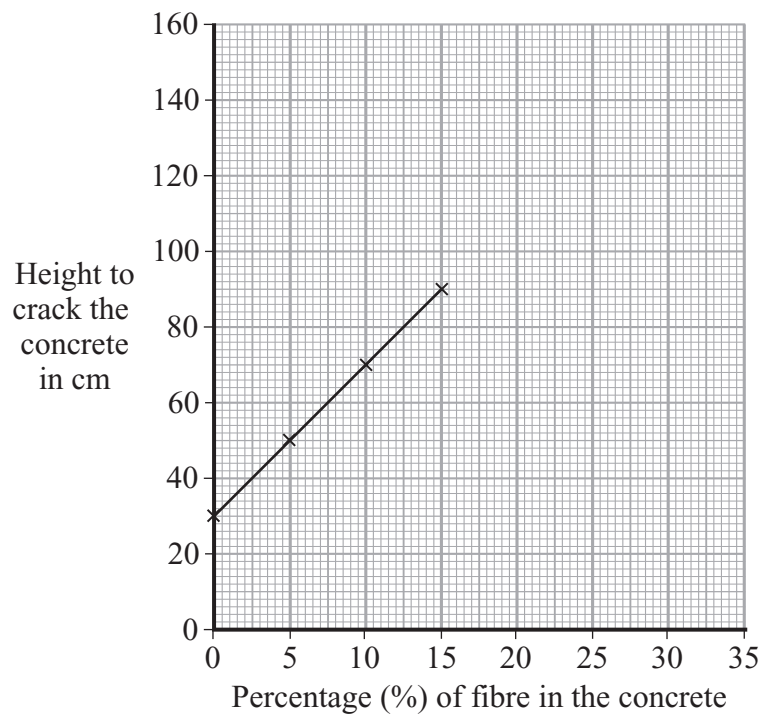
**QUESTION NINE**

Concrete is used as a building material.

A student tests four concrete slabs by dropping a steel ball onto them. The concrete slabs are of equal thickness but contain different amounts of fibre. The student drops the steel ball from increasing heights, until the concrete cracks.



The results are shown on the graph.



**9A** The student is investigating . . .

- 1 the composition of the concrete.
- 2 the flexibility of the concrete.
- 3 the hardness of the concrete.
- 4 the thickness of the concrete.

**9B** The student then tests a concrete slab that contains 30 % fibre.

From what height do you estimate the ball will need to be dropped to crack this concrete slab?

- 1 140 cm
- 2 145 cm
- 3 150 cm
- 4 155 cm

**9C** The dependent variable in this experiment is . . .

- 1 the percentage of fibre in the concrete.
- 2 the height from which the ball is dropped.
- 3 the thickness of the concrete slabs.
- 4 the size of the ball.

**9D** The best conclusion that can be made from the results so far is that a concrete slab cracks more easily . . .

- 1 as the size of the slab increases.
- 2 as the thickness of the slab increases.
- 3 as the percentage of fibre it contains increases
- 4 as the percentage of fibre it contains decreases.

**END OF TEST**

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Foundation Tier is earlier in this booklet.

## HIGHER TIER

### SECTION ONE

Questions **ONE** and **TWO**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

#### QUESTION ONE

This question is about four hydrocarbons in crude oil.

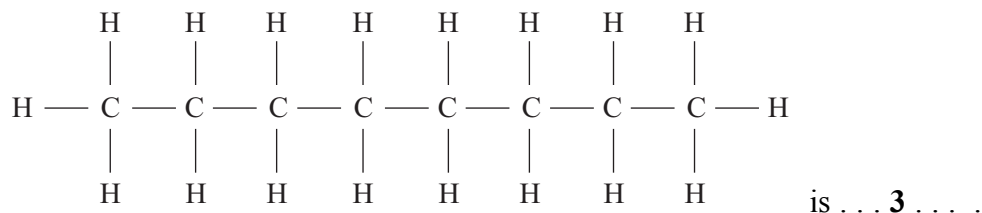
Name of hydrocarbon	Formula	Boiling point (°C)
<b>A</b> methane	CH <sub>4</sub>	– 162
<b>B</b> pentane	C <sub>5</sub> H <sub>12</sub>	+ 36
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<b>D</b> nonane	C <sub>9</sub> H <sub>20</sub>	+ 150

Match hydrocarbons, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

The hydrocarbon with the highest boiling point is ... **1** ... .

The hydrocarbon which is a gas at 0 °C is ... **2** ... .

The hydrocarbon with the structural formula



The hydrocarbon with 17 atoms in a molecule is ... **4** ... .

**QUESTION TWO**

Balanced equations show the amounts of the substances involved in chemical reactions.

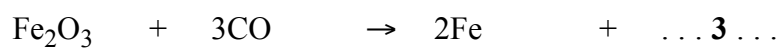
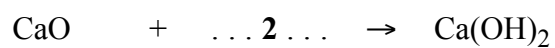
Match formulae, **A**, **B**, **C** and **D**, with the numbers 1–4 in the equations.

**A** CO<sub>2</sub>

**B** 3CO<sub>2</sub>

**C** H<sub>2</sub>O

**D** 2H<sub>2</sub>O



**Turn over for the next question**

**Turn over ►**

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**SECTION TWO**Questions **THREE** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION THREE**

National parks are beautiful areas where people can enjoy the countryside. People live and work in national parks.

In some national parks there are large limestone quarries. The limestone is usually transported from the quarries by road to all parts of the country.

The development of large quarries means a loss of habitat for wildlife, although areas can be restored when quarrying is finished.

**3A** One argument **for** limestone quarrying in national parks is that . . .

- 1 it creates more space for wildlife.
- 2 it provides jobs for local people.
- 3 it provides a large area for people to enjoy.
- 4 it reduces visual pollution.

**3B** One argument **against** limestone quarrying in national parks is that . . .

- 1 it encourages wildlife to live in the national parks.
- 2 there are no roads in the national parks.
- 3 quarries make unsightly scars on the landscape.
- 4 we do not use limestone for buildings now.



**3C** Transporting limestone by road causes noise pollution, air pollution and damage to buildings.

These problems could be reduced by . . .

- 1 transporting the limestone by lorries at night.
- 2 transporting the limestone by rail.
- 3 using larger lorries.
- 4 using smaller lorries.

**3D** Limestone is an important raw material in the manufacture of . . .

- 1 aluminium.
- 2 cement.
- 3 copper.
- 4 sulfur dioxide.

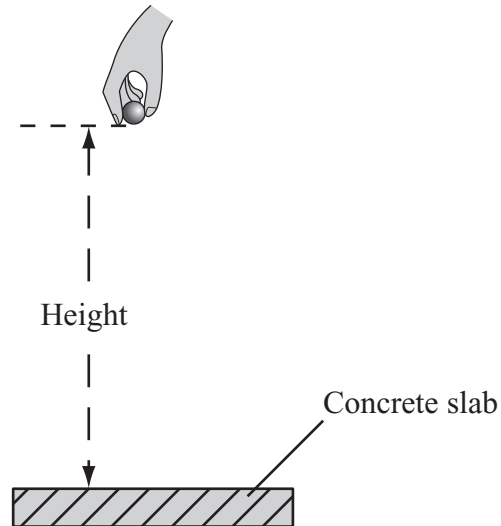
**Turn over for the next question**

**Turn over ►**

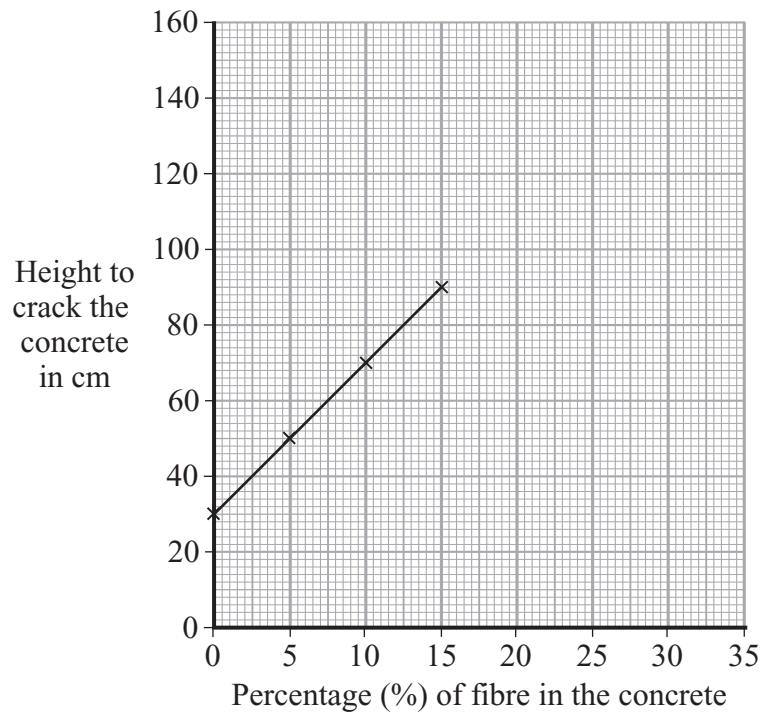
**QUESTION FOUR**

Concrete is used as a building material.

A student tests four concrete slabs by dropping a steel ball onto them. The concrete slabs are of equal thickness but contain different amounts of fibre. The student drops the steel ball from increasing heights, until the concrete cracks.



The results are shown on the graph.



---

**4A** The student is investigating . . .

- 1 the composition of the concrete.
- 2 the flexibility of the concrete.
- 3 the hardness of the concrete.
- 4 the thickness of the concrete.

**4B** The student then tests a concrete slab that contains 30 % fibre.

From what height do you estimate the ball will need to be dropped to crack this concrete slab?

- 1 140 cm
- 2 145 cm
- 3 150 cm
- 4 155 cm

**4C** The dependent variable in this experiment is . . .

- 1 the percentage of fibre in the concrete.
- 2 the height from which the ball is dropped.
- 3 the thickness of the concrete slabs.
- 4 the size of the ball.

**4D** The best conclusion that can be made from the results so far is that a concrete slab cracks more easily . . .

- 1 as the size of the slab increases.
- 2 as the thickness of the slab increases.
- 3 as the percentage of fibre it contains increases.
- 4 as the percentage of fibre it contains decreases.

**Turn over ►**

**QUESTION FIVE**

This question is about obtaining metals.

**5A** Rocks from which metals can be extracted economically are called . . .

- 1 alloys.
- 2 fossil fuels.
- 3 ores.
- 4 sedimentary rocks.

**5B** Gold is found in some rocks as the metal itself.

This is because gold . . .

- 1 is a reactive metal.
- 2 is a soft metal.
- 3 is an unreactive metal.
- 4 reacts with water but not with oxygen.

**5C** The method used to extract a metal from its compounds depends on . . .

- 1 the colour of the metal.
- 2 the density of the metal.
- 3 the hardness of the metal.
- 4 the reactivity of the metal.

**5D** Aluminium is extracted from aluminium oxide by electrolysis.

One reason why the process is expensive is that . . .

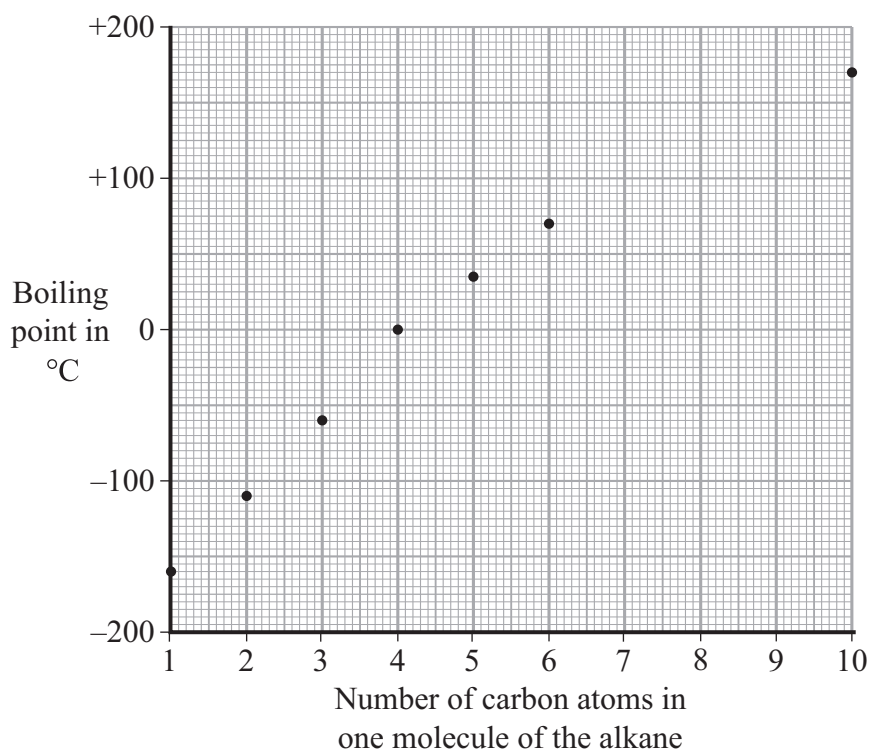
- 1 aluminium cannot be recycled.
- 2 aluminium has a low density.
- 3 aluminium is very easily corroded.
- 4 electrolysis uses a large quantity of energy.

**Turn over for the next question**

**Turn over ►**

**QUESTION SIX**

The boiling points of seven alkanes are plotted on the grid.



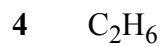
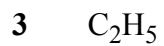
**6A** What is the relationship between the size of the alkane molecules and their boiling points?

- 1 Alkanes with small molecules have higher boiling points.
- 2 Boiling point increases as the size of the molecules increases.
- 3 Boiling point is directly proportional to the size of the molecules.
- 4 The larger the molecules, the lower the boiling point.

**6B** The alkanes that are gases at room temperature ( $20^{\circ}\text{C}$ ) are those in the range . . .

- 1  $\text{C}_1$  to  $\text{C}_4$
- 2  $\text{C}_1$  to  $\text{C}_5$
- 3  $\text{C}_1$  to  $\text{C}_6$
- 4  $\text{C}_5$  to  $\text{C}_{10}$

**6C** The formula for the alkane with two carbon atoms is . . .



**6D** When a pure alkane burns, which gas is never produced?

1 carbon dioxide

2 carbon monoxide

3 water vapour

4 sulfur dioxide

**Turn over for the next question**

**Turn over ►**

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**QUESTION SEVEN**

Iron is extracted from its ores in a blast furnace, where very high temperatures are needed. The iron that comes from the blast furnace is called pig iron and contains about 4% carbon. Impurities can be removed from pig iron to make pure iron.

**7A** A blast furnace is operated continuously, sometimes for several years, without a break.

One reason for this is . . .

- 1 to improve the quality of the iron.
- 2 to keep down the cost of the energy used.
- 3 so that large stockpiles of ore do not accumulate.
- 4 so that less waste slag is produced.

**7B** Pig iron cannot be used for making sheets for car panels.

This is because . . .

- 1 it is too brittle.
- 2 it is too dark in colour.
- 3 it is too easily scratched.
- 4 it melts at a very low temperature.

**7C** Pure iron is soft and easily shaped because iron atoms . . .

- 1 are small and spherical.
- 2 can slide over each other.
- 3 are constantly moving.
- 4 can rotate.



**7D** Scrap iron can be recycled to obtain iron metal.

Why does it take less energy to make iron from scrap iron than from iron ore?

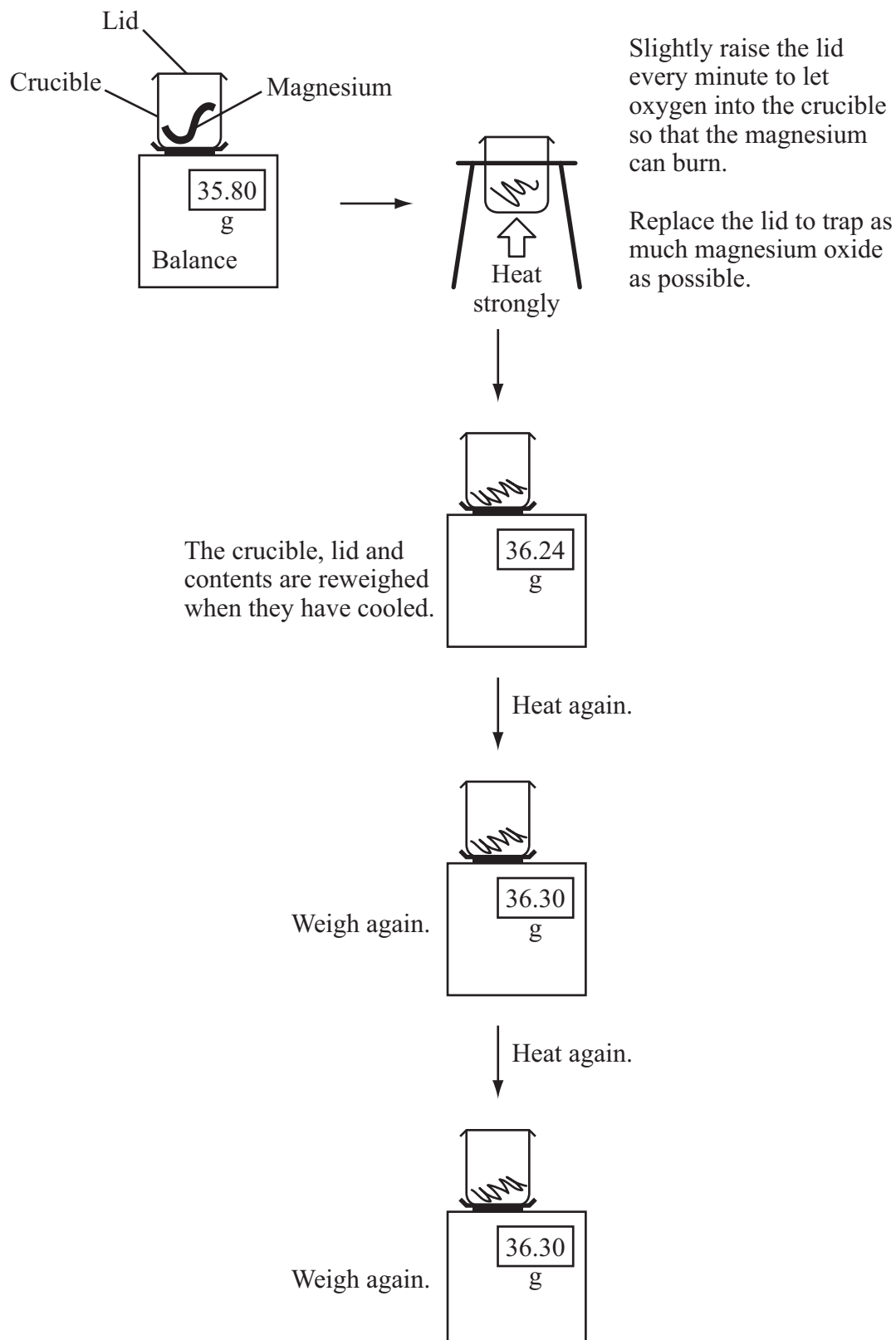
- 1 Scrap iron does not need to be reduced to iron.
- 2 Scrap iron is pure iron oxide.
- 3 There are more waste products from scrap iron.
- 4 There are more impurities in scrap iron.

**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

A student investigated the change in mass when some magnesium burned completely in oxygen.



- 
- 8A** The heating and weighing were repeated . . .
- 1 because the student did not allow the crucible to cool until the third weighing.
  - 2 because the student did not include the mass of the crucible lid until the third weighing.
  - 3 to check the accuracy of the balance.
  - 4 to make sure that all the magnesium had reacted.
- 8B** By how much did the mass of the crucible, lid and contents increase in this experiment?
- 1 0.05 g
  - 2 0.06 g
  - 3 0.44 g
  - 4 0.50 g
- 8C** What is the best explanation for the increase in mass in this experiment?
- 1 The magnesium oxide includes the mass of the magnesium and the mass of the oxygen with which it reacted.
  - 2 Magnesium oxide is a compound, but magnesium is an element.
  - 3 The magnesium oxide is hot, but the magnesium is cold.
  - 4 The volume of the magnesium oxide produced is greater than the volume of the magnesium used.
- 8D** The student calculated that the mass of the crucible, lid and magnesium oxide should have been 36.52 g rather than 36.30 g.
- The best explanation for this difference is that . . .
- 1 the student did not use the correct mass of magnesium.
  - 2 some of the magnesium oxide began to decompose.
  - 3 some magnesium oxide escaped from the crucible.
  - 4 the student did not heat the apparatus for long enough.

**QUESTION NINE**

Cars can be designed to use either petrol or ethanol ( $C_2H_5OH$ ) or a mixture of the two as fuel.

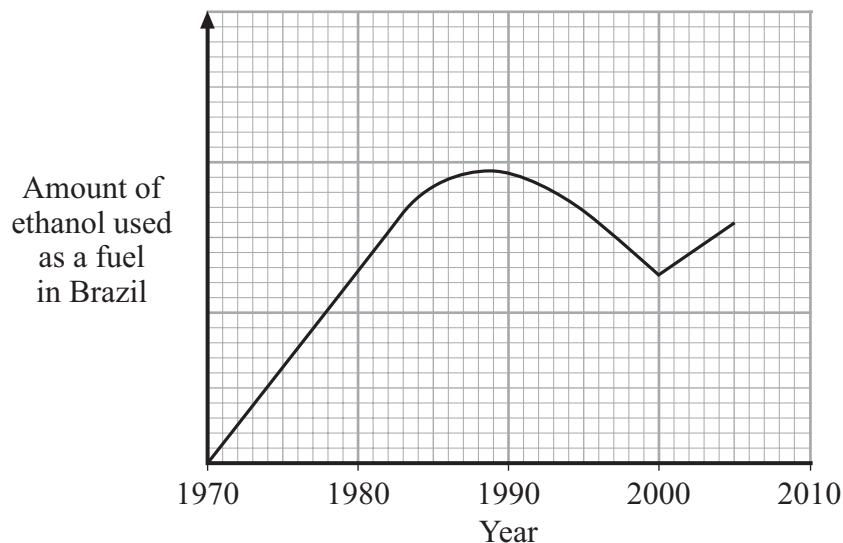
Ethanol and petrol produce similar amounts of carbon dioxide and water when they burn.

Petrol contains mainly hydrocarbons and is obtained from crude oil by fractional distillation.

Ethanol is made from sugar cane by fermentation and distillation.

- 9A** Why do environmentalists state that the burning of ethanol, produced from sugar cane, is neutral, in terms of pollution?
- 1 The hydrogen in the ethanol forms water.
  - 2 Green plants, while producing sugars, take up as much carbon dioxide as is produced by burning ethanol.
  - 3 There are no polluting waste gases produced when ethanol burns.
  - 4 Any waste sugar cane would release carbon dioxide when it decomposed.

The graph shows how the amount of ethanol used as a fuel has changed over the last few years in Brazil.



Before 1970, most cars in Brazil were fuelled by petrol.

80% of Brazil's crude oil was imported, leading to oil shortages in the late 1960's.

Since then, oil production in Brazil has increased five-fold.

Brazil has a hot and humid climate, ideal for growing sugar cane. There are large areas of land available for agriculture.

In 1970, the Brazilian Government instructed that all petrol must contain at least 20% ethanol.

There were Government subsidies for more ethanol production, more distilleries were built and an excellent fuel distribution network was developed. Also more cars were sold that could use only pure ethanol as fuel.

- 
- 9B** One reason for the decline from 1988 in the amount of ethanol used as a fuel in Brazil was a shortage of ethanol.

Another possible reason could have been . . .

- 1 an increase in Government subsidies to the ethanol industry.
- 2 Brazil had to import large quantities of expensive ethanol from Britain.
- 3 too much sugar cane was grown.
- 4 a decrease in the price of petrol.

- 9C** From about the year 2000, Brazil's car manufacturers began to produce dual-fuel cars which can run on ethanol, petrol or any mixture of these two fuels.

One advantage to Brazil's motorists will be . . .

- 1 they will never be short of fuel for their cars.
- 2 there will be far more cars in the cities.
- 3 they will be able to use the cheapest fuel available.
- 4 there will be much less carbon dioxide in the air in the cities.

- 9D** From the evidence on the graph and the information given, it is possible to predict that in Brazil . . .

- 1 there will be an increase in the amount of ethanol used as a fuel.
- 2 ethanol production will have to be increased by about 50%.
- 3 there will be a decrease in the amount of petrol used as a fuel.
- 4 the price of petrol will now fall quickly.

**END OF TEST**

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